

DESCRIPTION OF CHANGES TO  
PAYLOAD INTEGRATION PLAN  
SPACE SHUTTLE PROGRAM  
AND  
SHUTTLE IONOSPHERIC MODIFICATION WITH PULSED LOCAL EXHAUST

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
--	Basic issue/P21327-001	08/10/95	All
1	Update sections 1.0 and 3.1/P21327-002	07/11/97	1,3
2	Update sections 1.0, 3.1, and 4.2.2/P21327-0003	02/19/98	1,3,4

Note: Dates reflect latest signature date of CR's received by PILS.

Changes are indicated by "\*\*\*\*\*" at the beginning of the paragraph.

## 1.0 INTRODUCTION

\*\*\*\* United States Air Force Space and Missile Center (USAF/SMC) on behalf of the Naval Research Laboratory (NRL) plan to use the Space Shuttle for examining ionospheric distortions caused by exhaust of the Orbiter's Orbital Maneuvering System (OMS) engines. Shuttle Ionospheric Modification with Pulsed Local Exhaust (SIMPLEX) requires 20 cooperative tests of Orbiter thruster firings on multiple flights. SIMPLEX will fly as a standard secondary payload.

\*\*\*\* SIMPLEX will not fly any hardware on the Shuttle. It is not a prepacked middeck locker and does not require any John F. Kennedy Space Center (KSC) processing. SIMPLEX will make use of five radar locations. They are Arecibo, Puerto Rico, Kwajalein, Marshall Islands, Milestone Hill, Massachusetts, Alice Springs, Australia, and Jicamarca, Peru.

For purposes of this Payload Integration Plan (PIP), the Space Shuttle Program (SSP) shall be composed of and represented by the Goddard Space Flight Center (GSFC), Lyndon B. Johnson Space Center (JSC) and the KSC. The SIMPLEX shall be represented by the USAF/SMC.

This PIP provides the management roles and responsibilities, and a definition of the technical activities, interfaces, and schedule requirements to accomplish the integration, launch, on-orbit operation, and postlanding operations of the SIMPLEX payload with the Space Shuttle. All services to be furnished by the SSP to the customer under this PIP shall be furnished by the SSP using its best efforts.

## 2.0 MANAGEMENT RESPONSIBILITIES

The responsibility for assuring the definition, control, implementation, and accomplishment of activities identified in this document is vested with the SSP at the JSC and for SIMPLEX with the USAF/SMC. Hereafter in this PIP, the USAF/SMC will be referred to as the customer, and the SIMPLEX will be referred to as the payload.

### 2.1 Joint Responsibilities

No unique requirements

#### 2.1.1 Documentation.- No unique requirements

authority and technical knowledge to make final programmatic recommendations to the MMT on issues which affect the payload.

### 3.0 PAYLOAD DESCRIPTION AND MISSION OVERVIEW

This section contains a general payload description and mission overview. It is not intended to specify requirements or constraints.

#### 3.1 Payload Description

\*\*\*\* The SIMPLEX payload has no flight hardware; Orbiter OMS thruster firings will be used to create ionospheric disturbances for observation by the SIMPLEX radars. SIMPLEX has five different radar sites used for collecting data: 1) Arecibo, 2) Kwajalein, 3) Milestone Hill, 4) Alice Springs, and 5) Jicamarca. One of the radar sites (Arecibo) will also use a low-level laser to observe the effects on the ionosphere resulting from the thruster firing.

The objective of the SIMPLEX activity is to determine the source of Very High Frequency (VHF) radar echoes caused by the Orbiter and its OMS engine firings. The Principal Investigator (PI) will use the collected data to examine the effects of orbital kinetic energy on ionospheric irregularities and to understand the processes that take place with the venting of exhaust materials. SIMPLEX sensors may collect data during any encounter opportunity when the Orbiter support activities meet the criteria defined.

#### 3.2 Mission Overview

##### 3.2.1 Integrated Ground Operations.- Not applicable

3.2.2 Flight Operations.- Once in orbit, the flightcrew will be available to support cooperative tests that will require Orbiter OMS thruster firings (with specific attitude control) while in a SIMPLEX opportunity timeframe. It is highly desirable that OMS thruster firings be dedicated and SSP planned firings scheduled over a SIMPLEX observation site. SIMPLEX operations and opportunity definitions will be negotiated between the customer and the SSP through the Flight Planning Annex, Annex 2.

##### 3.2.3 Postlanding.- Not applicable

## 4.0 MISSION OPERATIONS

The mission operations section includes a definition of requirements and constraints by mission phase.

### 4.1 Payload Control Parameters

Not applicable

### 4.2 Operational Requirements and Constraints

Details of the SIMPLEX tests to be performed are contained in the Flight Planning Annex, Annex 2, Part II.

#### 4.2.1 Launch Readiness.- Not applicable

\*\*\*\* SECTION 4.2.2 HAS CHANGED

4.2.2 On-orbit.- There are no unique altitude or inclination requirements, (desired altitudes for the SIMPLEX tests are at altitudes between 200 and 400 Km). Annex 2, Part II defines the specific support requirements. The SIMPLEX tests are listed below. These are all the possible tests defined for each radar site. The PI will prioritize the types of burns based on the opportunity. Each radar site must obtain at least 1 night and 1 day burn before the SIMPLEX requirements can be met. A total of 20 tests are required for the SIMPLEX payload. The PI prefers to have a 5-sec two-engine OMS burn, but will settle for a 10-sec single-engine OMS burn.

SIMPLEX TEST		LIGHTING
1.	OMS Burn (Ram)	Night
2.	OMS Burn (Wake)	Night
3.	OMS Burn (90 deg)	Night
4.	OMS Burn (Ram)	Day
5.	OMS Burn (Wake)	Day
6.	OMS Burn (90 deg)	Day

Note 1: The ram, wake, and 90 deg indicate the relative direction between the engine thrust vector and the Orbiter velocity vector.

#### 4.2.2.1 On-orbit Attitude: No unique requirements

#### 4.2.2.2 Thermal Environment: Not applicable

#### 4.2.2.3 Photographic Coverage: Not applicable

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